Zoonoses and emerging infectious diseases

Delia Grace
Program Leader, Food Safety and Zoonoses
International Livestock Research Institute, Nairobi, Kenya

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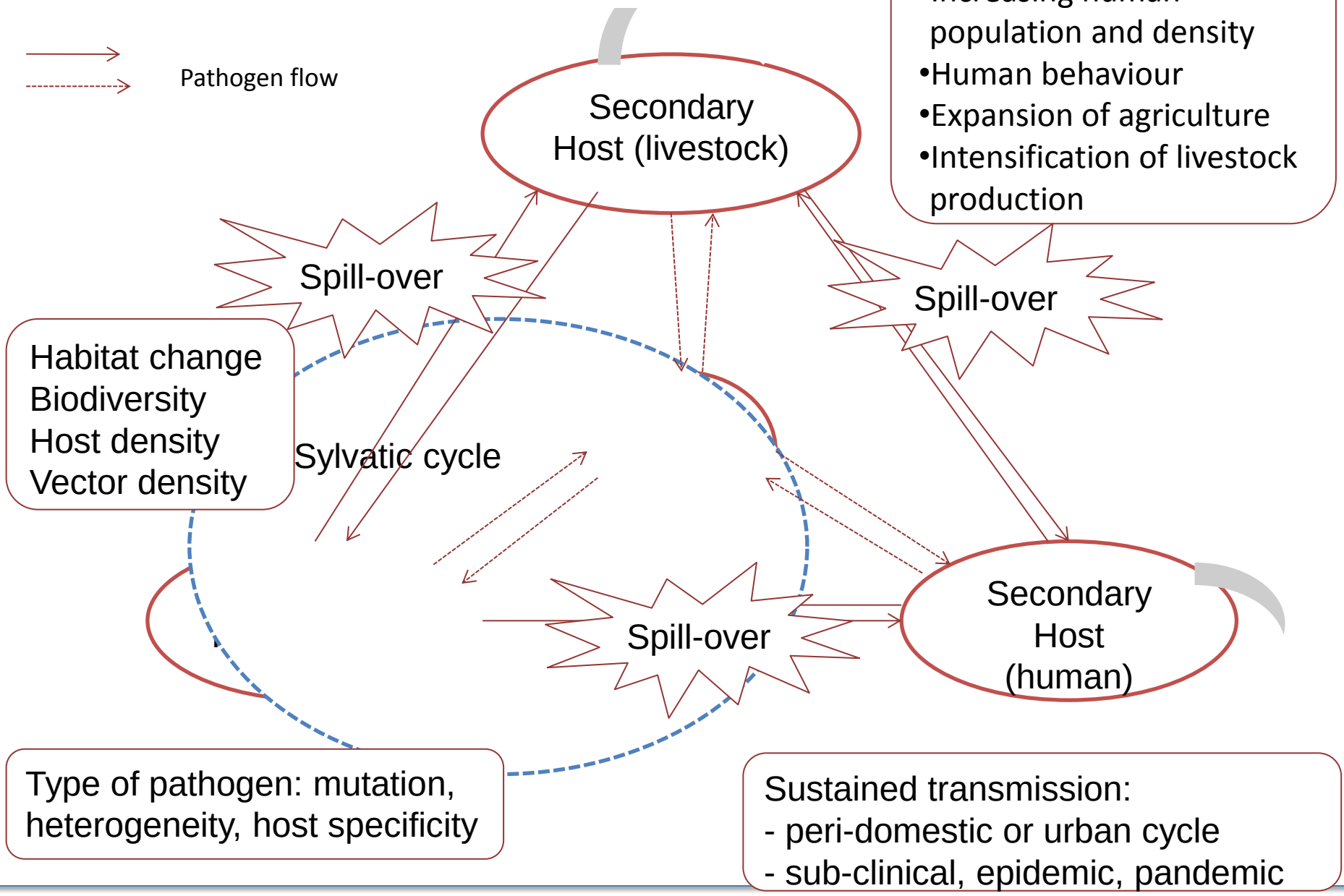
Overview

- **Zoonoses: the lethal gifts of livestock and wildlife**
  - Emerging infectious disease
  - Neglected zoonoses
  - Costs of disease
- **Drivers of disease**
  - Demography and increasing demands
  - Land use change and environmental degradation
- **One Health solutions for zoonoses**
  - Understanding disease
  - Surveillance and response
  - Addressing underlying causes

Where do we get our diseases?

- Few are Legacies
  - Paleolithic baseline: yaws, staph, pinworms, lice, typhoid, tb
- Most are Earned
  - Degenerative diseases: heart failure, stroke, diabetes, cancer
  - Allergies, asthma, autoimmune diseases
  - Sexually transmitted infections such as HSV-2, gonorrhea
- Many are Souvenirs
  - Around 60% of human diseases shared with animals
  - 75% of emerging infectious disease zoonotic

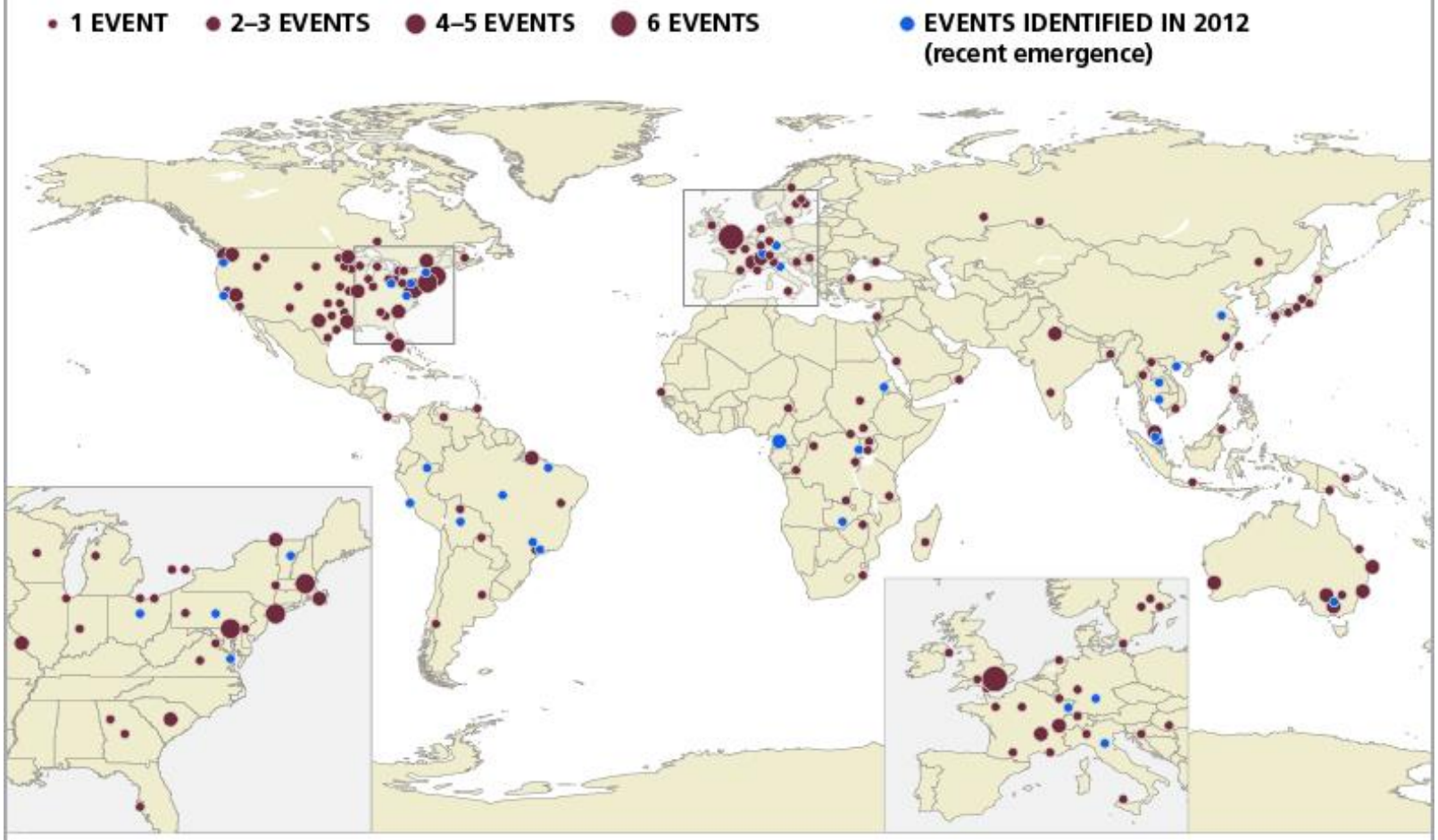
Spillover!


Pathogen flow
Secondary Host (livestock)
•Increasing human population and density
•Human behaviour
•Expansion of agriculture
•Intensification of livestock production
Spill-over
Spill-over
Habitat change
Biodiversity
Host density
Vector density
Sylvatic cycle
Spill-over
Secondary Host (human)
Type of pathogen: mutation, heterogeneity, host specificity
Sustained transmission:
- peri-domestic or urban cycle
- sub-clinical, epidemic, pandemic

Emerging Zoonotic Disease Events, 1940–2012

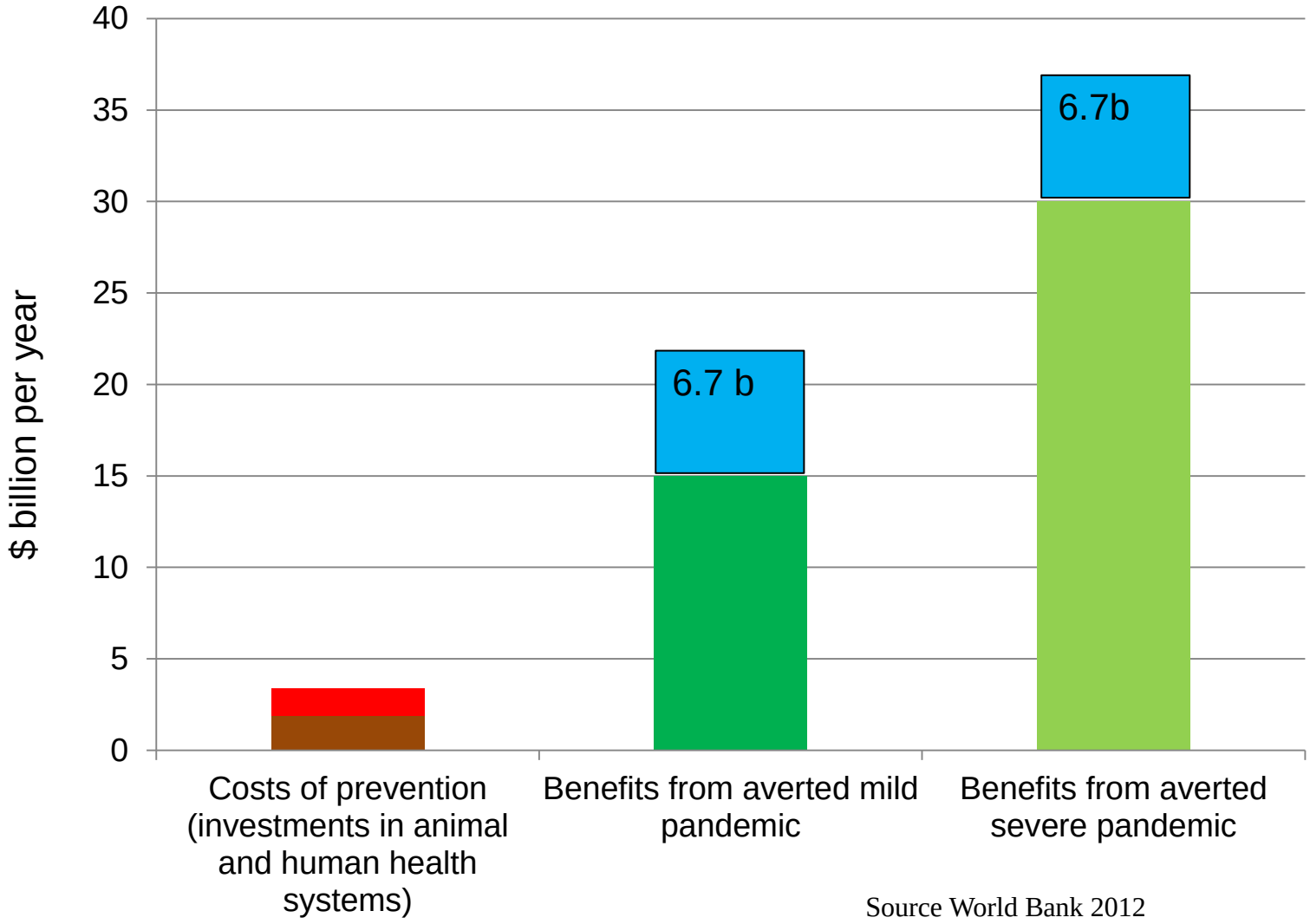
Potential Hotspots in US, Western Europe, Brazil, Southeast Asia

Most emerging human diseases come from animals. This map locates zoonotic events over the past 72 years, with recent events (identified by an ILRI-led study in 2012) in blue. Like earlier analyses, the study shows western Europe and western USA are hotspots; recent events, however, show an increasingly higher representation of developing countries.



Map by IOZ, published in an ILRI report to DFID: *Mapping of Poverty and Likely Zoonoses Hotspots*, 2012.

Annual expected benefits of prevention of pandemic and non-pandemic outbreaks

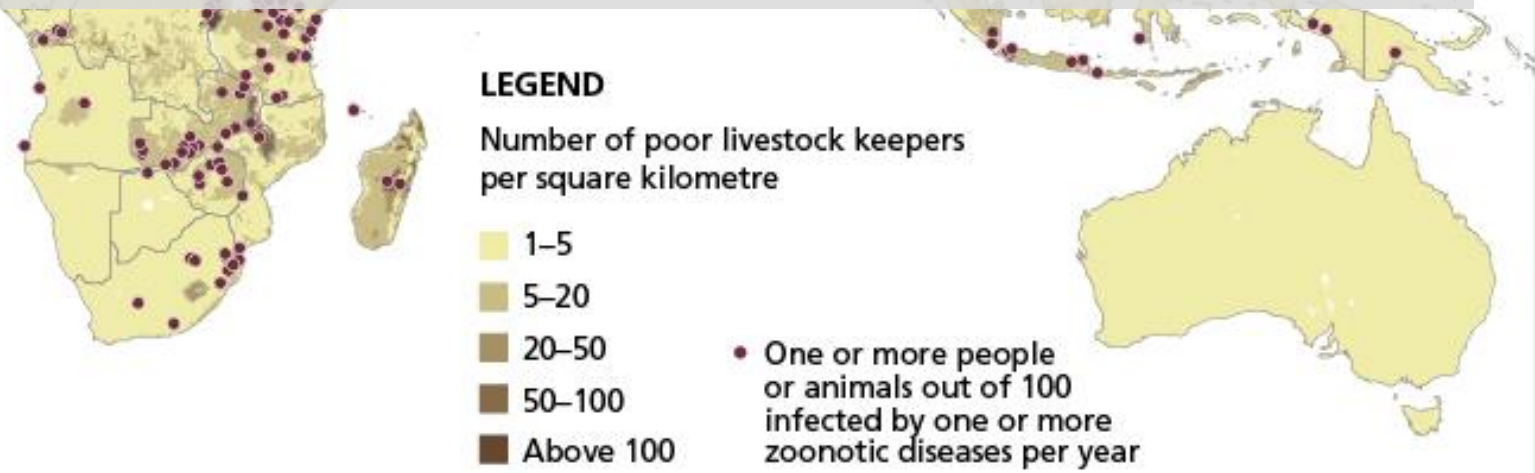


Source World Bank 2012

Young girl presenting her pet chicken to culling team during a mass cull, Indramayu District January 2006. Photo by Peter Roeder.

Greatest burden of endemic zoonoses falls on on billion poor livestock keepers

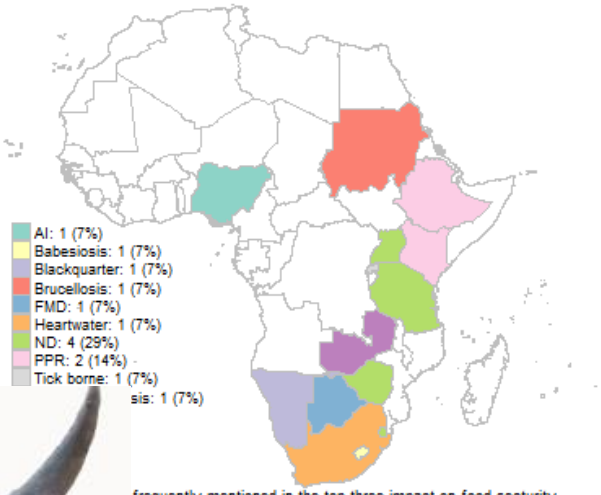
- **Unlucky 13 zoonoses sicken 2.4 billion people, kill 2.2 million people and affect more than 1 in 7 livestock each year**



Map by ILRI, from original published in an ILRI report to DFID: *Mapping of Poverty and Likely Zoonoses Hotspots*, 2012.

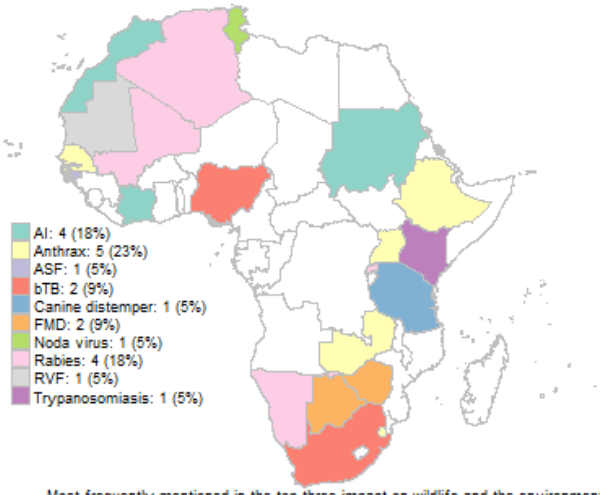
Livestock disease huge burden

Greatest impact on food security (anglophone only)



frequently mentioned in the top three impact on food security
is: 8(11%) - bTB: 7(9%) - Anthrax: 6(8%) - ND: 6(8%)

Greatest impact on wildlife and the environment



Most frequently mentioned in the top three impact on wildlife and the environmen
Rabies:11(21%) - Anthrax:10(19%) - FMD: 6(11%) - AI:4(8%)

Annual mortality of African livestock

	Young	Adult
Cattle	22%	6%
Shoat	28%	11%
Poultry	70%	30%

Source: Otte & Chilonda; IAEA

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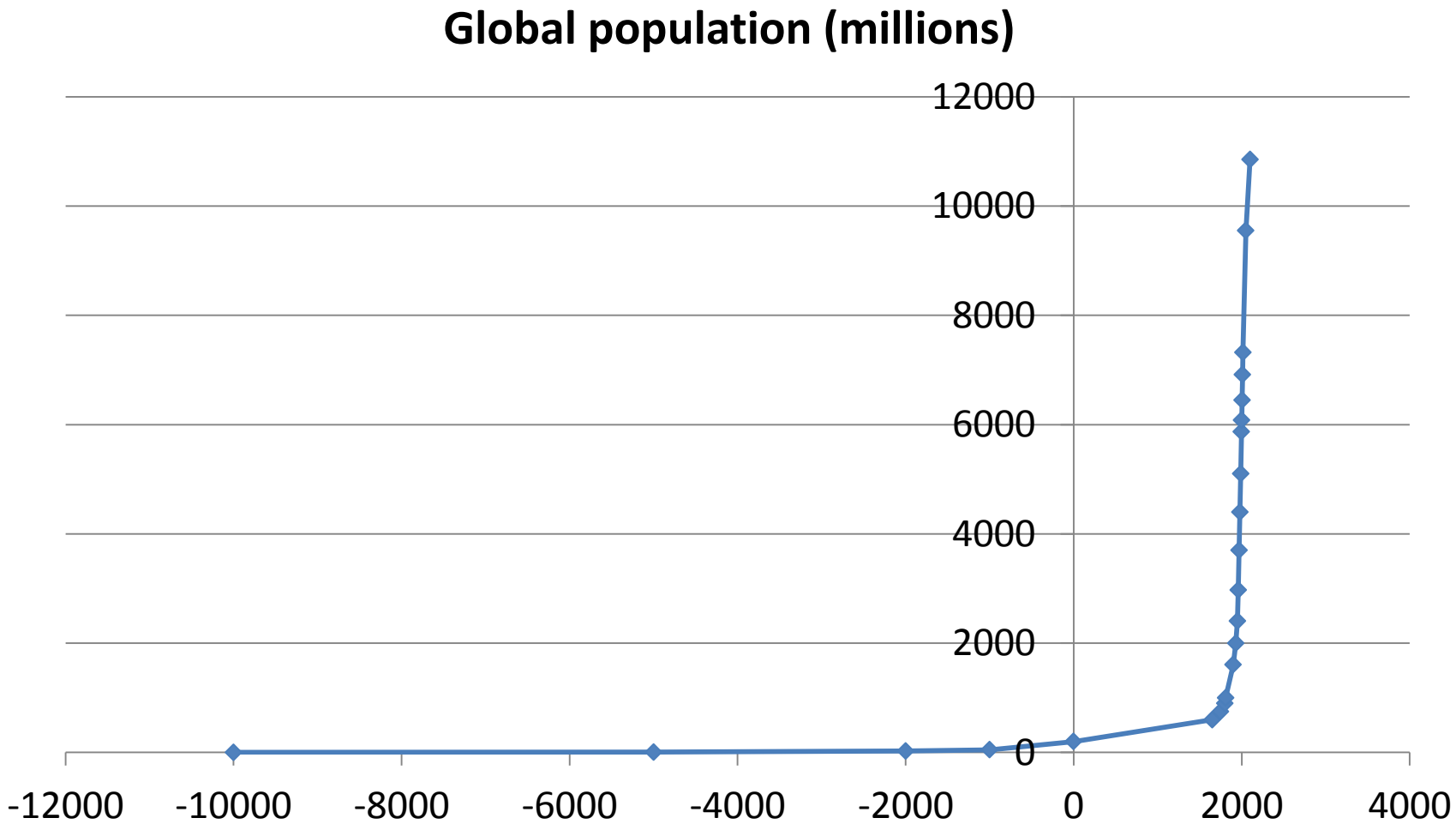
Exponential population growth

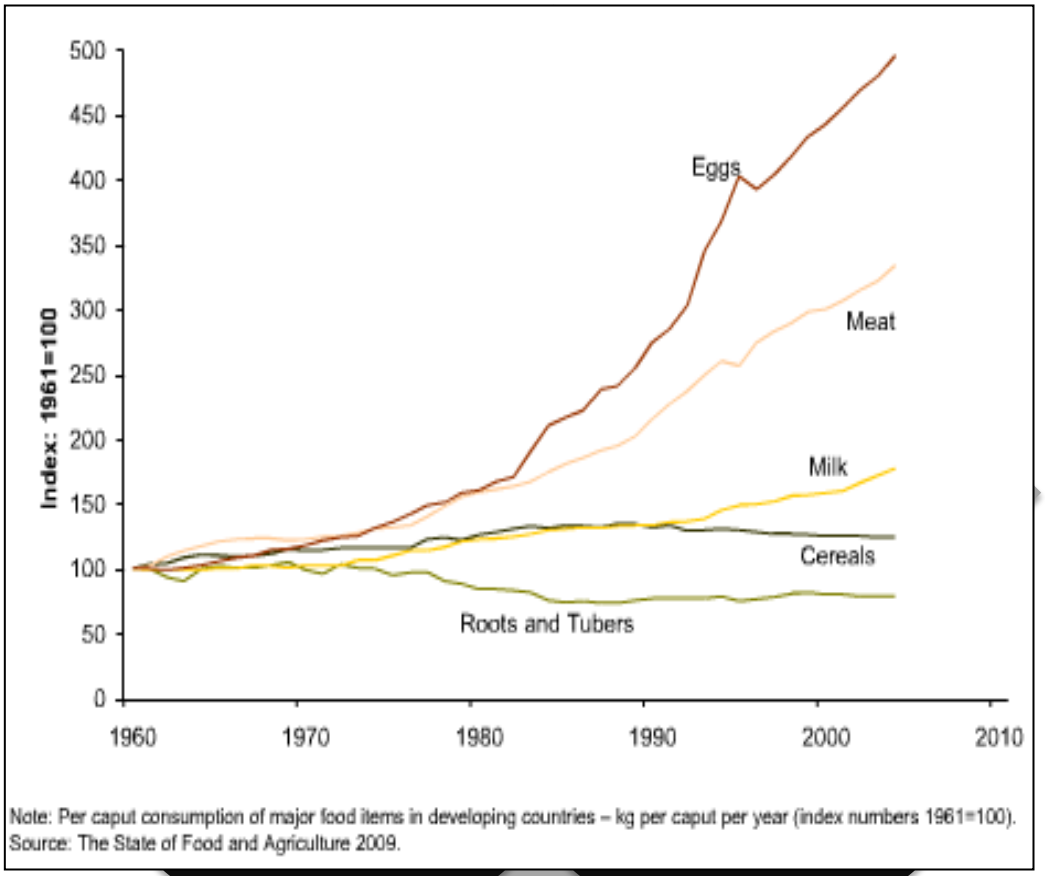


Feeding the world

(2.5 billion more to feed by 2050)

Climate change

(temperatures to rise by 1-3.5° C by 2100)



Note: Per caput consumption of major food items in developing countries – kg per caput per year (index numbers 1961=100).
Source: The State of Food and Agriculture 2009.

Land use change

Urbanization/irrigation

Biodiversity change

Environmental degradation

Adapted from Smith J 2011

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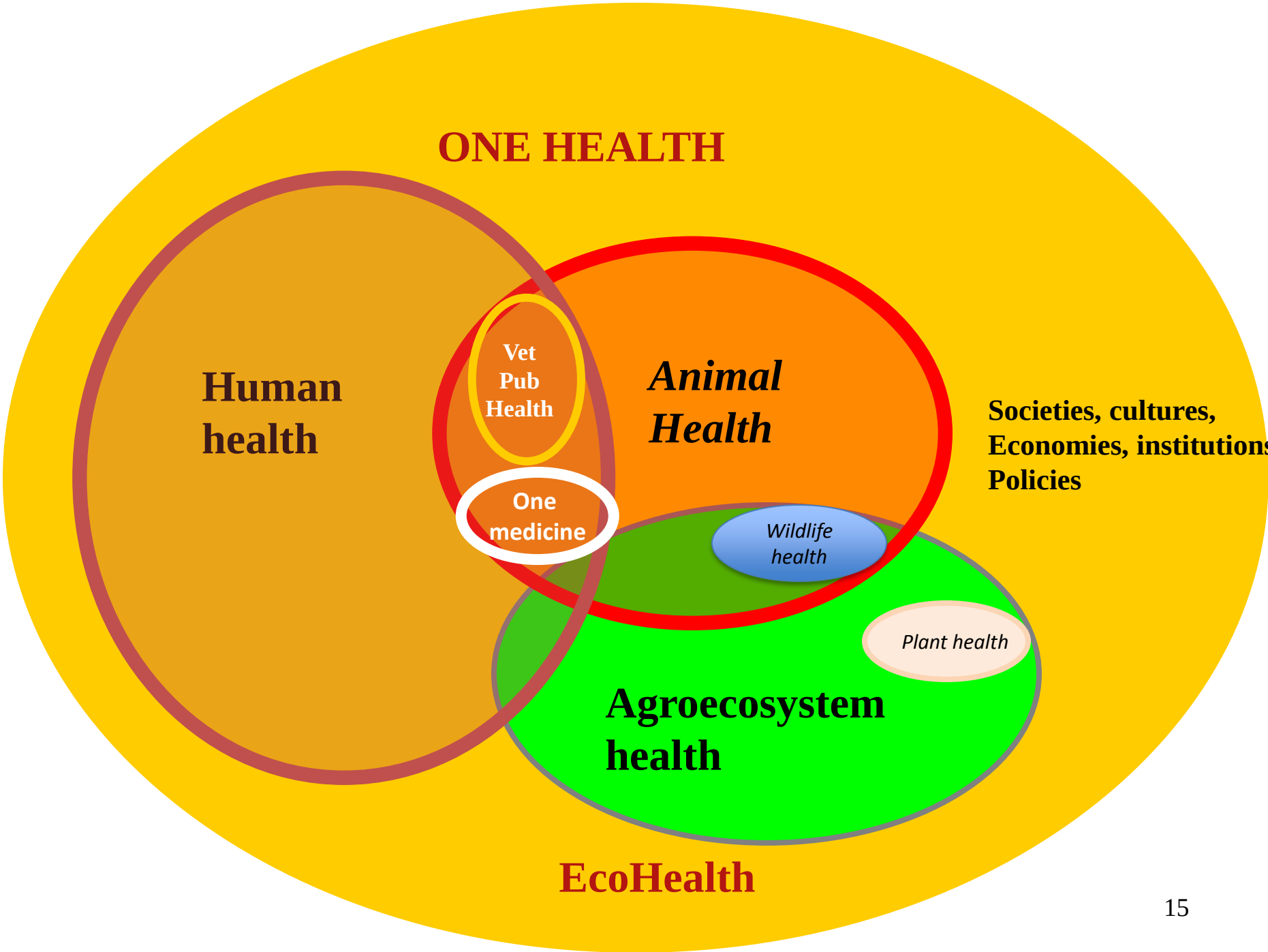
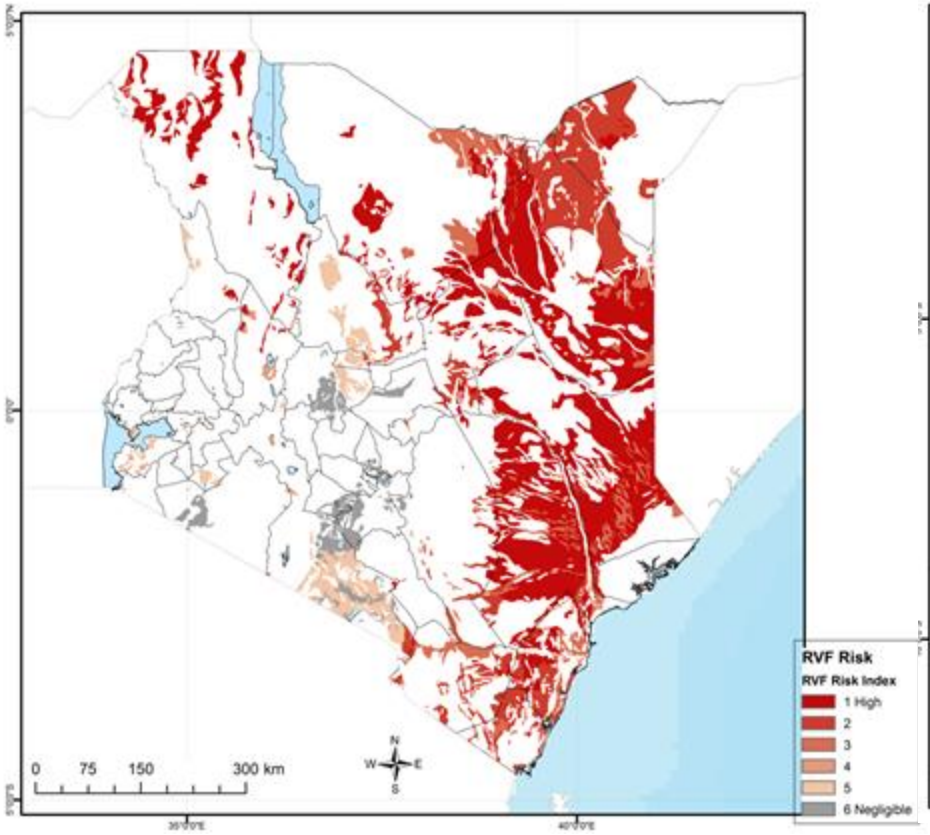
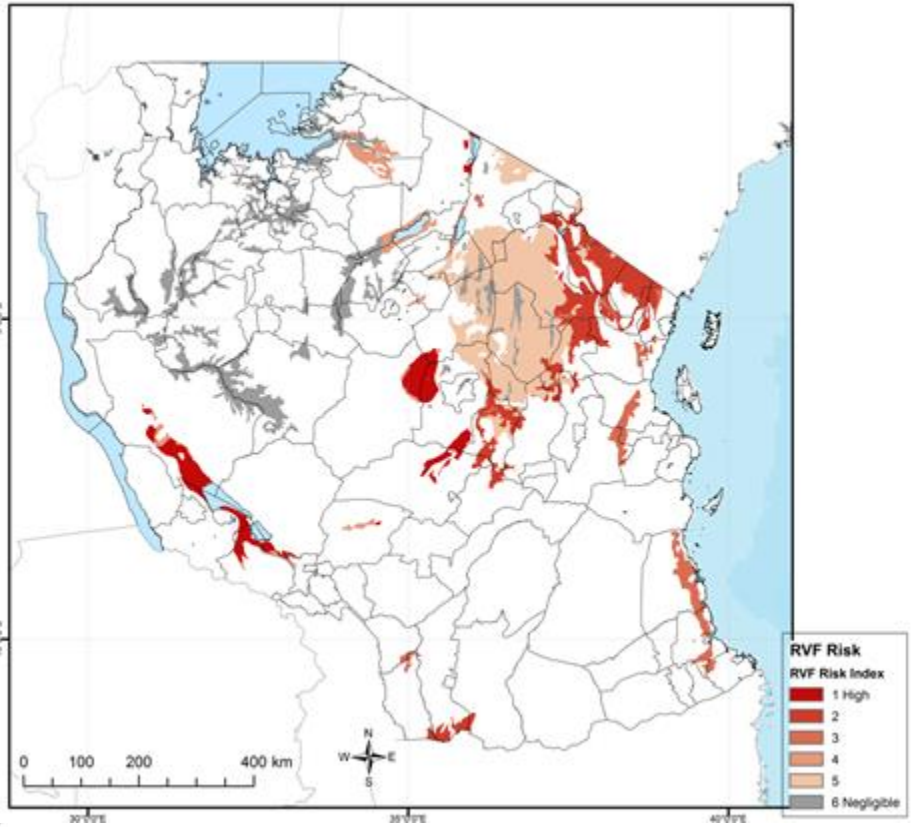

ONE HEALTH
Human health
Vet Pub Health
One medicine
Animal Health
Wildlife health
Plant health
Agroecosystem health
Societies, cultures,
Economies, institutions
Policies
EcoHealth

Potential RVF hotspots in eastern Africa



Kenya



Tanzania

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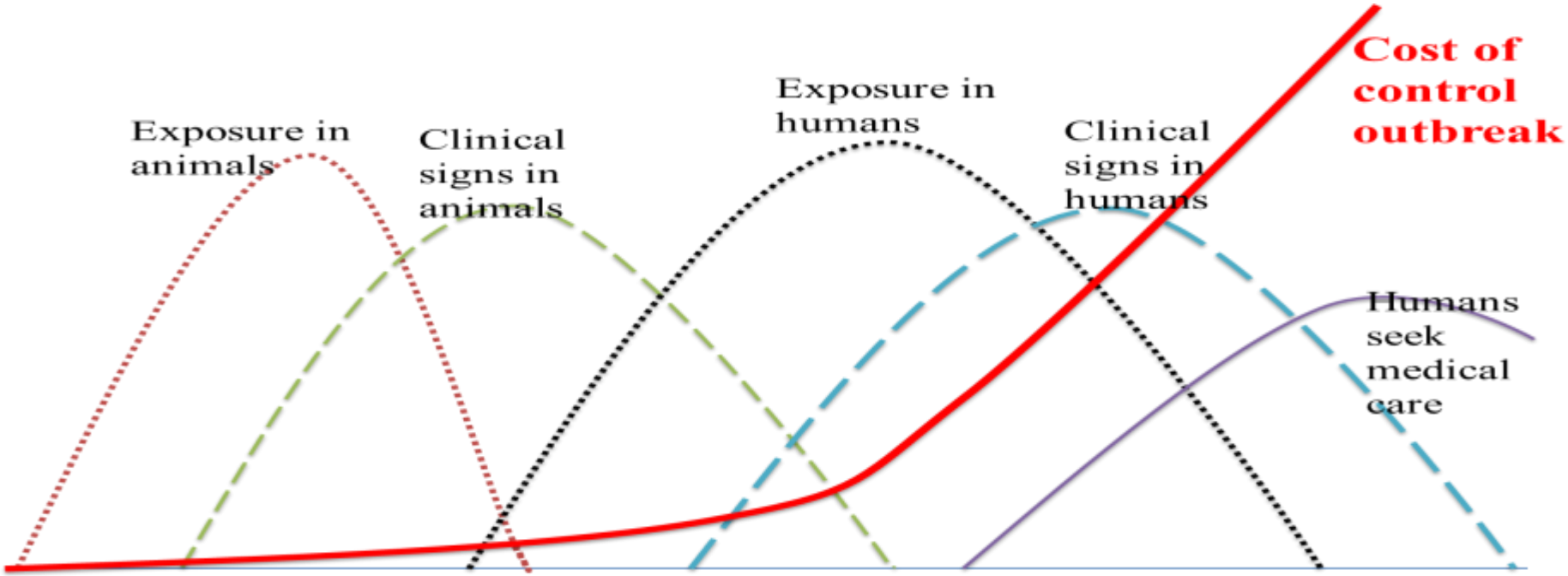
Timely responses to reduce impacts

- Surveillance and response in animal hosts can reduce costs by 90%



Adapted from IOM 2009

Agriculture Associated Diseases

http://aghealth.wordpress.com/

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RESEARCH PROGRAM ON Agriculture for Nutrition and Health

Led by IFPRI